

Chapter B7:

Conclusions

The results of EPA's evaluation of I&E rates at CWIS in the Delaware Estuary transition zone indicate that cumulative impacts can be substantial. As summarized in Chapter B3, Tables B3-21 and B3-22, the cumulative impingement impact amounts to over 9.6 million age 1 equivalent fish per year (over 332,000 lb of fishery yield foregone), and the entrainment-related losses are much greater, at nearly 616 million age 1 equivalent fish lost (and more than 16 million lb of fishery yield foregone).

EPA's analysis shows that even when losses at individual facilities in the transition zone appear insignificant, the total of all I&E impacts on the same fish populations can be sizable. For example, an estimated 43,764 age 1 equivalents of weakfish are lost as a result of entrainment at Hope Creek, which operates with closed cycle cooling and therefore has relatively low entrainment rates. However, the number of total weakfish age 1 equivalents lost as a result of entrainment at all transition zone CWIS is over 2.2 million (Chapter B3, Table B3-15).

EPA has conservatively estimated such cumulative impacts on Delaware Estuary species by considering the I&E impacts of only transition zone CWIS. In fact, many of the species affected by CWIS within the transition zone move in and out of this area, and therefore may be exposed to many more CWIS than those considered here (see Figure B1-1 in Chapter B1). Regardless of the geographic extent of an evaluation of cumulative impacts, it is important to consider how I&E rates relate to the relative abundance of species in the source waterbody. Thus, low I&E does not necessarily imply low impact since it may reflect low population abundance, which can result from numerous natural and anthropogenic factors, including long-term I&E impacts of multiple CWIS. On the other hand, high population abundance in the source waterbody and associated high I&E may reflect waterbody improvements that are independent of impacts from or improvements in CWIS technologies. Or, high levels of I&E impacts on a species may indicate a high susceptibility of that given species to CWIS effects.

In addition to estimating the physical impact of I&E in terms of numbers of fish lost because of the operation of all in-scope and out-of-scope CWIS in the Delaware Estuary transition zone, EPA also examined the estimated economic value of the losses from I&E. Chapter B4 provides an indication of the estimated cumulative impact of I&E at the all in-scope and out-of-scope CWIS in the case study area, based on data available for the Salem facility and then extrapolated to the other facilities on the basis of flow. As indicated in Chapter B4, average baseline losses from all facilities in the case study area for impingement are valued at between roughly \$0.5 million and \$1.1 million per year, and average baseline losses from entrainment are valued at between approximately \$23.4 million and \$48.5 million per year (all in \$2000).

EPA also developed a random utility model (RUM) to provide primary estimates of the recreational fishery losses associated with I&E in the Delaware case study area. As shown in Chapter B5, the average annual recreation-related fishery losses at all facilities in the transition zone amount to approximately \$5.0 million per year (impingement and entrainment impacts combined). For the in-scope facilities covered by the proposed Phase 2 rule, the losses due to I&E were estimated via the RUM to amount to approximately \$4.2 million per year. Results for the RUM analysis (Chapter B5) were merged with the benefits transfer-based estimates (Chapter B4) in a manner that avoids double counting.

EPA also estimated the economic benefits of a range of I&E reductions for the four in-scope CWIS in the case study area (Chapter B6). For the benefits analysis, adjustments to I&E rates were made to suitably reflect the regulatory baseline (i.e., to reflect changes some facilities made over the years to reduce I&E). Benefits estimates were then based on percentage reductions (from 10 percent to 90 percent) in estimated current I&E for the regulation-impacted facilities (Salem, Hope Creek, Edge Moor, and Deepwater). The resulting estimates of the economic value of benefits for reduced I&E range from \$0.3 million to \$0.5 million per year for 60% impingement loss reductions, and from \$17.8 million to \$31.7 million per year for 70% entrainment loss reductions (all in \$2000).

In interpreting the results of the case study analysis, it is important to consider several critical caveats and limitations of the analysis. These caveats have been detailed in each preceding chapter. In the economic valuation component of the analysis, valuation of I&E losses is often complicated by the lack of market value for forage species, which may comprise a large proportion of total losses. For example, EPA estimates that over 527 million age 1 equivalents of bay anchovy may be lost to

entrainment at transition zone CWIS each year (over 85 percent of the total of more than 616 million estimated lost age 1 individuals for all species combined, as shown in Chapter B3, Table B3-15). Bay anchovy has no direct market value, but it is nonetheless a critical component of estuarine food webs. EPA included forage species impacts in the economic benefits calculations as discussed in Chapter A9 of Part A, but because techniques for valuing such losses are limited, the final estimates may well underestimate the full ecological and economic value of these losses. Thus, on the whole, EPA believes the estimates developed here underestimate the economic benefits of reducing I&E.